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258. By **J. M. Arnold**, *Boston, Mass.*—The Balance of a watch is slightly heavier on one side than on the other. When the watch is placed vertically with the pendant up, the heavy point is at the lowest side when the balance is at rest.

If the watch be started with a small arc of vibration the rate will be much faster, in the vertical position, with the pendant up than with the pendant down. If the motive power be increased so that the arc of vibration becomes large, say one and a half revolutions or 270° each side the point of rest, it will be found to go faster, in the vertical position, pendant down than it does with the pendant up.

What arc of vibration must be given the balance, so that its rate shall be the same in any vertical position?

Query 1. By **Prof. Hall.**—When we descend below the surface of the Earth, does the Earth's attractive force increase or diminish?

Query 2. By **Mr. Kummell.**—Let $\cos^2\varphi$ be the probability of a single event, hence $\sin^2\varphi$ that of its non-occurrence. Supposing $m$ simultaneous events of either kind, then we have for the mean square of the difference in number, after an infinite number of trials, the expression:

$$\varepsilon_m^2 = \cos^{2m}\varphi(m)^2 + \frac{m}{1}\cos^{2m-2}\varphi\sin^2\varphi(m-2)^2 + \frac{m}{1}\cdot\frac{m-1}{2}\cos^{2m-4}\sin^4\varphi(m-4) + \ldots$$

$$+\frac{m}{1}\cdot\frac{m-1}{2}\cdots\frac{m-n+1}{n}\cos^{2m-2n}\varphi\sin^{2n}\varphi(m-2n)^2 + \ldots\sin^{2m}\varphi(-m)^2 = m(\sin^2 2\varphi + m\cos^2 2\varphi)$$

Since $m(\cos^2\varphi - \sin^2\varphi) = m\cos 2\varphi$ is the most probable difference in the number of the two kinds of events, we have $\sin 2\varphi\sqrt{m}$ for the mean error with respect to the most probable difference. How is this proved otherwise than by induction?

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## *PUBLICATIONS RECEIVED.*

*Physical and Mathematical Principles of the Nebular Theory;* 10 pages, 8vo:
*The Origin of the Power which Causes the Stellar Radiations;* 10 pages, 8vo:
*Elements of Sidereal Astronomy;* 7 pages, 8vo: By Jacob Ennis, A. M., Professor of Natural Science in the State Normal School, Shippensburg, Pa.

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## *ERRATA.*

On page 47, line 5, insert ½ before the sign of integration.
" " " " 7, multiply the term under the sign of integration by $d\phi$.
" " " " 9, for $n$—3, read $n$—2.